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ABSTRACT

The study was intended to determine the effect of the mode of verbalization of a discovered generalization on short-term retention of ability to use the generalization. Fifty preservice elementary teachers were assigned to one of the five verbalization methods: speaking, listening, writing, reading, or no verbalization. Each performed on six discovery tasks; three on sorting and three on numerical problems. After the discovery was made, the subject verbalized the generalization in the manner assigned. Criterion measures consisted of presentation of six new instances ten minutes after discovery. No significant differences in retention existed between methods of verbalization. (JG)

Verbalizing Method Influence on Short-Term Retention of Discovered Generalizations

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Objective The intent of this study was to gain evidence about the following question: Does the manner in which verbalization of a discovered generalization takes place affect the short-term retention of ability to use the generalization? The five verbalizing methods included having the subject speak, the subject listen, the subject write, the subject read, and no verbalizing at all. The methods actually involving verbalization can be described by citing the source (S or source external to S) and mode (oral or written).

Background

Hendrix (1947) "Verbalizing a generalization immediately after discovery may actually decrease transfer power" (p. 198).

Schwartz (1948) "A recently formed concept may be destroyed by the unsuccessful effort to verbalize it" (p. 63, emphasis added).

Retzer (1970) No significant differences (.05) were found among the effects due to treatments with no verbalization required, a read verbalization, or a written verbalization required.

Method Fifty undergraduate college subjects were randomly selected from the enrollment in a multi-section mathematics course required for prospective elementary teachers; ten were assigned to each of the verbalizing methods. In individual interviews, the subjects were given six discovery tasks of two sorts: sorting problems and numerical problems. The three sorting problems consisted of correctly assigning multi-attribute blocks or cards to groups. The numerical problems consisted of determining short-cut methods of performing arithmetic operations for selected situations (for example, the sum of the first n odd numbers can easily be determined by calculating n^2).

During the interview, an instance (a correct categorization of a block/card or a correct answer to a numerical problem) was shown to S and he was then asked to respond (categorize or calculate the answer) to a new instance. If he responded correctly within fifteen seconds, he was permitted to study the work completed to that point for ten seconds and then he was shown another instance. If he did not respond correctly within fifteen seconds, the correct response was given by the interviewer, S was permitted to study the work, and then he was shown another instance. S was deemed to have discovered a generalization when he correctly categorized four consecutive blocks/cards or when he correctly responded to two consecutive numerical instances. Immediately after each discovery was made, the generalization was verbalized by the method assigned to S (S spoke his generalization, S listened to E read a generalization, S wrote his generalization, S read a generalization, or S merely studied the work without any verbalizing). The motive given for this after-look was "to help you (the S) remember better."

After all the discovery tasks had been completed, to provide a "forgetting" time each S worked with a tiltboard maze game (Labyrinth) for ten minutes. A retention test consisting of six new instances amenable to the earlier generalizations was then administered.

Results Analyses of covariance of the retention test scores were planned, with covariates ACT mathematics usage score and the total number of instances required to discover the generalizations. However, since a lack of homogeneity of regression for the five verbalizing methods was indicated ($F(8,34) = 2.76$), regular ANOVAs were used, a one-way for the effects due to the five verbalizing methods and a two-way (2 sources x 2 modes) for the effects due to the corresponding four methods. Neither analysis yielded significant differences (0.05, all $Fs < 1$). Homogeneity of regression not being rejected (0.05) for all the methods except the subject-listen method, the n.s.d. conclusion was supported by a one-way analysis of covariance (variables as described above, $F < 1$).

Significance This study indicated that as far as short-term retention is concerned, there is no superior method for verbalizing a discovered generalization of sorting or numerical problems by college students. Hence, the choice of having a student speak, write, read, or listen to a verbalization of a discovered generalization--or even requiring no verbalization at all--is a matter of preference or convenience, with respect to short-term retention. Whether this conclusion can be extrapolated to younger subjects and to long-term retention remains to be seen, but the results do cast further doubt on the Hendrix hypothesis.

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Figure 1. Verbalization Combinations

		Source: Subject	Source: External
Mode: Written		1. Subject writes generalization.	2. Subject reads generalization.
Mode: Oral		3. Subject speaks generalization.	4. Subject listens to generalization.
None		5. There is no verbalization of the generalization.	

Figure 2. The Discovery Tasks. (Numerals give order on test.)

A. The Sorting Problems

	Description	Sorting rule
2.	Attribute blocks--4 shapes, 2 thicknesses, 2 colors, star/no star	Sort according to same color and thickness.
4.	Cards--2 shapes, 2 sizes, lined/unlined, 2 figure types, 2 colors, 1/2 figures, shaded/unshaded figures, extra/no extra figure	Sort according to presence of lines and shading.
6.	Attribute blocks--4 shapes, 2 thicknesses, 2 sizes, star/no star	Sort according to same thickness and star/no star.

B. The Short-cut Problems

1. $\sum_{k=1}^{n} (2k-1) = n^2$

3. $(10n + a)\ (10n + [10-a]) = 100n(n + 1) + a(10 - a)$

   a, n integers on test,

   with $0 < a < 10$, $n > 0$

5. $\prod_{k=1}^{n} \left(1 + \frac{2k + 1}{k^2}\right) = (n + 1)^2$

TABLE 1

Descriptive Statistics
For Retention Test Scores

Group	Mean	Std. Dev.	Adj. Mean*	Adj. Std. Dev.*
Read	4.00	0.94	4.00	0.27
Listen	4.20	0.79	--	--
No-verbalization	3.90	0.88	3.87	0.27
Write	4.00	0.82	3.95	0.27
Speak	4.20	0.79	4.28	0.27
Combined	4.06	0.82	--	--

*Adjustment for the groups listed based on ACT Mathematics Usage Score and total instances required.

Note. Maximum score was 5. Data for one discovery task (number 1 in Figure 2) were not used because of possible instruction on it.